Indian Currency Detection System For Blind People

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Abstract- *This project addresses the challenges faced by India's visually impaired population (18 million people) in managing currency independently. We aim to develop an accessible Android application using advanced image recognition to confidently identify Indian currency notes. The system ensures 99 percent accuracy in currency recognition and 90 percent success in counterfeit detection. Beyond India, the vision is to provide global currency recognition for financial independence. The proposed solution incorporates an emergency alert feature for prompt assistance and location sharing. The current lack of universally accessible solutions makes quick and efficient transactions challenging for blind individuals. Our innovation strives to bridge this gap by offering an efficient, user-friendly solution through an Android application, enabling visually impaired individuals to manage their money effortlessly.*

Keywords: *Visually impaired, Currency recognition, Android application, Image recognition, Financial independence, Counterfeit detection.*

I. INTRODUCTION

In India, the challenges faced by the visually impaired, comprising 18 million individuals, in managing their finances independently are immense. Identifying and distinguishing between various currency notes poses a significant hurdle, limiting their financial autonomy (Project Overview). Existing solutions, such as Braille markings and tactile features, often prove inconvenient, emphasizing the urgent need for an innovative and universally accessible approach to empower the visually impaired in currency recognition (Problem Statement).The proposed mission is to develop a groundbreaking Android application that not only addresses the intricate task of discerning Indian currency values but also ensures an exceptional 99 percent accuracy in currency recognition and a 90 percent success rate in counterfeit currency detection (Project Overview). This endeavor is particularly crucial in the aftermath of significant currency changes and demonetization, which have compounded the challenges faced by the visually impaired in managing their finances independently.

Visually impaired individuals currently rely on imperfect solutions, such as assistance from others or tactile features like Braille, which can be cumbersome and time-consuming, hindering the efficiency of transactions. Our innovative technology aims to bridge this gap by leveraging image comparison, denomination extraction, and currency value recognition. This Android application will serve as a lifeline for the visually impaired, providing instantaneous audio feedback upon scanning currency notes through the smartphone's camera, announcing the denomination aloud (Problem Statement The foundation of our approach draws inspiration from recent research in the field. Vaishak et al. (2022) present an efficient model for currency and fake currency detection, employing machine learning and image processing techniques to enhance security in currency transactions[1]. Another notable contribution comes from S.V.Tresa Sangeetha et al. (2022), who developed a Currency Detection App for Blind People utilizing MIT App Inventor and artificial intelligence tools for image classification [2]. Additionally, Qian Zhang and Wei Qi Yan (2020) use deep learning, specifically the Single Shot MultiBox Detector (SSD) model, achieving remarkable accuracy in currency recognition [3]. These studies inform our project's foundation and underscore the significance of integrating advanced technologies for comprehensive currency recognition solutions (Project Overview)

Addressing the challenges faced by the visually impaired in currency recognition, our project is propelled by a comprehensive exploration of recent research in the field ([1]-[6]). The visually impaired, comprising 18 million individuals in India, struggle with independent financial management, particularly in discerning currency values with efficiency and accuracy ([Project Overview]). Existing solutions, such as Braille markings, prove cumbersome and time-consuming, necessitating an innovative and universally accessible approach to empower the visually impaired in currency recognition ([Problem Statement]). Additionally, Kalpna Gautam (2022) focuses on Indian currency recognition using an image recognition technique, introducing a real-time application for feature-based recognition with local binary patterns and principal component analysis ([4]). Rohith Pokala and Varun Teja (2020) contribute a study on Indian Currency Recognition for Blind People, emphasizing the identification of various denominations, including 50, 100, 500, 2000, 20, and 10 rupees [5]. M. Laavanya and V. Vijayaraghavan (2019)

delve into real-time fake currency note detection using deep learning, addressing the rising problem of counterfeit currency, particularly in denominations of 2000, 500, 200, and 50 rupees [6].

Through the integration of insights from these studies, our project aspires to significantly contribute to the financial independence of visually impaired individuals globally ([Project Overview]).

II. OBJECTIVE

In addition to aiding the visually impaired, the project extends its impact to mute individuals by introducing an innovative hand gesture-based communication system. The overarching goal is to create a dual-purpose system seamlessly integrating real-time object detection and hand gesture-based communication.

Through this approach, the project aims to significantly contribute to building a more inclusive society where technology serves as a bridge, catering to the diverse needs of individuals with visual and speech impairments. The project's success will be measured by its capacity to provide instant information, offer a reliable communication channel, and undergo continuous refinement based on user feedback, ensuring its practical applicability in real-world scenarios.

Moreover, these currency detection projects recognize the importance of continuous advancements in technology, particularly in the realms of voice command interactions and machine learning algorithms. By staying at the forefront of technological innovation, these initiatives seek to adapt and incorporate emerging technologies, ensuring sustained relevance and effectiveness.

III. LITERATURE SURVEY

Title:

Currency and Fake Currency Detection using ML and Image Processing: An Android Studio Application for the Blind (2022)

Authors: Vaishak B, Hoysala S, Pavankumar V H, Mohana

Summary:

The paper, authored by Vaishak B and team, presents an innovative model employing MATLAB to address the critical challenge of currency and fake currency detection. The focus is on identifying the authenticity of currency through a meticulous examination of images. The proposed model utilizes advanced techniques in machine learning to map extracted features to standard values, ensuring a robust framework for distinguishing genuine from counterfeit currencies with a high degree of accuracy.

Beyond traditional approaches, the methodology involves the slicing of currency images, extracting region-specific features, and leveraging the intensity variations in these sliced sections. This nuanced analysis forms the basis for establishing the originality of the currency notes. The authors report an efficiency rate of 95% and above, highlighting the model's effectiveness in differentiating between authentic and counterfeit currencies.

The significance of this research extends to the development of an Android Studio application tailored for the visually impaired. By integrating machine learning algorithms and image processing techniques, the proposed application serves as an accessible tool for the blind, enabling them to independently discern the authenticity of currency notes. This advancement aligns with the broader goal of enhancing financial independence for individuals with visual impairments.

Title:

Currency Detection App for Blind People Using MIT App Inventor (2022)

Authors:

S.V.Tresa Sangeetha, T.Porselvi, Venkateshwarn A, Venkateshwaran A, Sathmikan I, Tharun Kumar P.

Summary:

In this pioneering work, S.V.Tresa Sangeetha and team introduce a revolutionary Android application meticulously crafted for the visually impaired community, harnessing the capabilities of MIT App Inventor. The application represents a significant leap forward in assistive technology, specifically tailored to enhance the financial independence of individuals with visual impairments. The authors ingeniously leverage artificial intelligence for efficient currency classification within the app, a groundbreaking feature that sets it apart in the realm of accessibility tools. By seamlessly integrating MIT App Inventor's user-friendly interface, the application empowers blind users with voice commands, revolutionizing the identification process for various currency denominations. This impactful approach not only addresses accessibility challenges but also serves as a testament to the potential of MIT App Inventor as a transformative tool for creating solutions that make a tangible difference in the lives of individuals with visual impairments.

Title:

Currency Detection and Recognition Based on Deep Learning (2020)

Authors:

Qian Zhang and Wei Qi Yan

Summary:

In their seminal work, Qian Zhang and Wei Qi Yan make a substantial contribution to the realm of currency recognition through the introduction of a robust methodology grounded in deep learning principles. The paper is a testament to the authors' commitment to advancing assistive technology and addressing the challenges faced by visually impaired individuals in currency identification.

The core focus of their approach revolves around the implementation of a sophisticated Single Shot Multi Box Detector (SSD) model and Convolutional Neural Network (CNN) for feature extraction. This intricate combination of cutting-edge technologies aims to achieve precise recognition of paper currency denominations, setting a new standard in the field. Beyond the technical intricacies, what distinguishes the authors' method is its exceptional average accuracy of 96.6%, underscoring its reliability and effectiveness in the nuanced task of currency recognition.

This commendable level of accuracy positions the proposed deep learning approach as not only a state-of-the-art solution but also a dependable tool for aiding visually impaired individuals. The authors' work extends beyond theoretical advancements, showcasing the real-world potential for widespread application in assistive technology. By achieving such high levels of accuracy, Qian Zhang and Wei Qi Yan's method emerges as a beacon of innovation, demonstrating its capacity to significantly contribute to advancements in currency recognition and, consequently, enhance the daily lives of individuals with visual impairments.

Title:

Fake Currency Detection using Image Processing (2021)

Authors: L. Latha, B. Raajshree

Summary:

In their comprehensive exploration of counterfeit currency challenges in India, L. Latha and B. Raajshree present a robust system that addresses the rising threat. This paper stands as a significant contribution to the field of currency detection, particularly in the context of ensuring the integrity of financial transactions.

The system introduced in the paper boasts an efficiency rate of 95% or higher, underlining its prowess in successfully classifying currency denominations. The authors achieve this through a meticulous process of comparing image intensities to established standards. This methodology reflects a commitment to precision and reliability in counterfeit currency detection, demonstrating the potential impact of image processing techniques in safeguarding financial systems.

By focusing on real-world challenges, L. Latha and B. Raajshree's work not only contributes to the theoretical understanding of counterfeit currency issues but also presents a practical solution with a high level of efficiency. The success of their system in classifying currency denominations underscores its potential significance in the ongoing efforts to combat counterfeit currency, protecting the integrity of financial transactions and systems.

Title:

Indian Currency Detection using Image Recognition Technique (2022)

Author: Kalpna Gautam

Summary:

In this groundbreaking study, Kalpna Gautam addresses the global issue of paper currency counterfeiting, with a specific emphasis on Indian currency recognition. The paper introduces a portable, real-time application designed for feature-based recognition, incorporating advanced techniques such as local binary patterns (LBP) and principal component analysis (PCA).

The methodology deployed in this work involves the utilization of Euclidean distance for metric combination, enhancing the precision of the recognition process. The system's innovative approach lies in its capacity to augment image information, simplifying the overall currency recognition process. This enhancement proves pivotal in aiding the detection of genuine currency notes, showcasing the practical implications of advanced image recognition techniques.

Title:

Indian Currency Recognition for Blind People (2020)

Authors: Rohith Pokala, Varun Teja

Summary:

In this significant contribution, Rohith Pokala and Varun Teja focus on addressing the challenge of currency recognition for visually impaired individuals, particularly in the context of India. The paper delves into the critical issue of enhancing accessibility for the blind in identifying currency denominations, showcasing a commitment to inclusivity.

The authors introduce a novel approach that allows for the recognition of denominations crucial to daily transactions, including 50, 100, 500, 2000, 20, and 10 rupees. By emphasizing the specific needs of visually impaired individuals, the paper strives to bridge the gap in financial independence. This targeted focus on Indian currency denominations aligns with the unique challenges faced by the visually impaired in the country, and the proposed solution has

the potential to significantly improve their ability to manage finances independently.

Project Insights from Literature Survey

The literature survey underscores the multifaceted nature of currency detection systems designed for the visually impaired. Drawing inspiration from various research papers, our proposed system embraces a comprehensive approach, incorporating Machine Learning (ML), Image Processing, Android Development using Flutter and Android Studio, and Voice Assistance. The integration of ML algorithms like Brute Force Classification, PCA, ORB, and LBP enhances the system's ability to accurately recognize diverse currency denominations. Additionally, the use of OpenCV for real-time image processing, coupled with Flutter and Android Studio for creating a user-friendly interface, ensures a seamless and inclusive experience for visually impaired users. The incorporation of Voice Assistance technology further enhances accessibility, allowing users to independently navigate and manage their finances.

In summary, the proposed system synthesizes key elements from the literature survey, aiming to set new benchmarks in efficiency and user-friendliness. By combining advanced technologies, the system seeks to empower visually impaired individuals, promoting financial independence through accessible and effective currency recognition.

IV. SYSTEM ARCHITECTURE

In this innovative currency detection system designed to empower blind individuals, the architecture seamlessly integrates cutting-edge technologies for accurate identification and enhanced accessibility. At its core, the system employs a Machine Learning (ML) module that incorporates advanced algorithms such as Brute Force Classification, Principal Component Analysis (PCA), ORB, and Local Binary Pattern (LBP) to robustly recognize various currency denominations. This ML module is complemented by an Image Processing component utilizing OpenCV, contributing to real-time functionality by efficiently capturing and processing currency notes.

The Android Development aspect of the system is built upon a dynamic combination of Flutter and Android Studio. Flutter, a versatile UI toolkit, facilitates the creation of a visually appealing and user-friendly interface from a single codebase. Simultaneously, Android

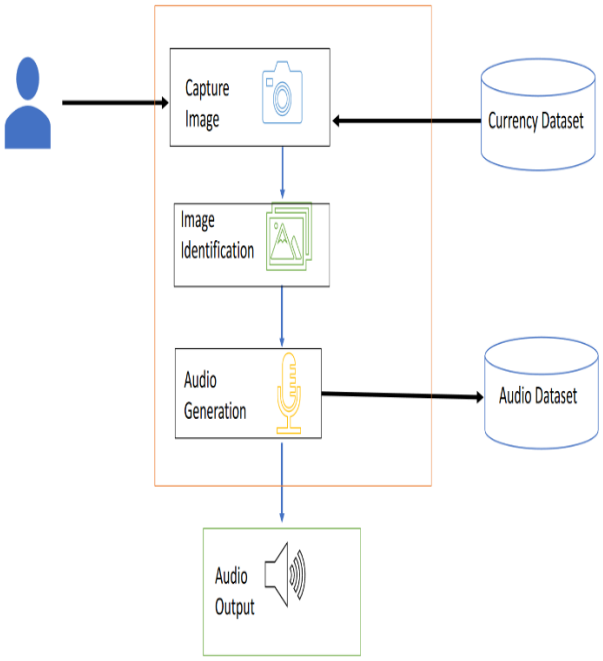


Fig 1. System Architecture

Studio, serving as the integrated development environment (IDE), ensures a robust platform for crafting the Android application with seamless integration of sophisticated features. Additionally, Voice Assistance technology is integrated to enhance accessibility, interpreting user commands through natural language processing (NLP) and providing real-time spoken feedback, thereby allowing visually impaired users to independently distinguish between different currency notes. This modular architecture, spanning Machine Learning, Image Processing, Android Development, and Voice Assistance, positions the system at the forefront of currency detection technology, promising new standards in efficiency, accuracy, and user-friendliness for individuals with visual impairments.

V. SYSTEM WORKING

The Android application for Indian currency detection provides users with a seamless experience for both security and functionality. Upon launching the app, users can log in or register an account. Once logged in, the application offers two main features accessible via the device's volume buttons. Pressing the volume up button sends an emergency message, while pressing the volume down button initiates the currency detection feature. This design ensures that essential functions are easily accessible, enhancing user convenience and safety. When the user selects the currency detection feature, the app requests camera permissions. Upon receiving permission, the app activates the camera, allowing the user to capture an image of the currency note.

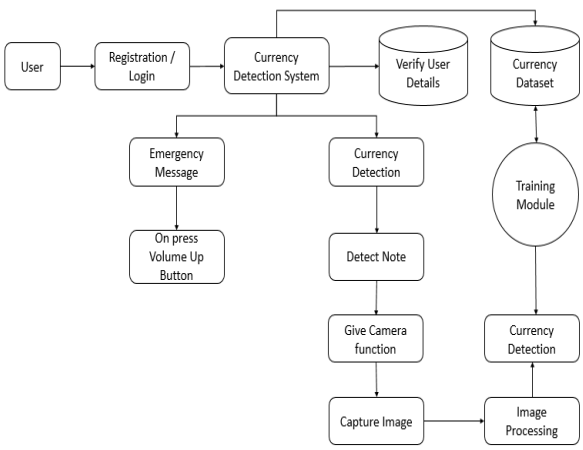


Fig 2. System Working

The captured image is processed using a pre-trained Convolutional Neural Network (CNN) model designed specifically for Indian currency detection. The CNN model analyzes the image to identify the denomination of the currency. Once the detection process is complete, the application provides the result through a voice output, informing the user of the currency denomination. This system leverages advanced machine learning techniques to ensure accurate detection and offers a user-friendly interface that integrates seamlessly with the device's hardware, providing both utility and accessibility.

VI. PROPOSED SYSTEM

The proposed currency detection system leverages cutting-edge technologies to ensure accurate identification for blind individuals, combining Machine Learning (ML), Image Processing, Android Development, and Voice Assistance. In the realm of ML, the system incorporates image pre-processing techniques, employing advanced algorithms such as Brute Force Classification, Principal Component Analysis (PCA), ORB (Oriented FAST and Rotated BRIEF) algorithm, and Local Binary Pattern (LBP). These ML algorithms play a crucial role in analyzing visual features, ensuring robust pattern recognition for diverse currency denominations.

In tandem, Image Processing technologies, including OpenCV (Open Source Computer Vision Library), enhance the system's ability to capture and process currency notes efficiently. The use of OpenCV contributes to the real-time functionality, enabling users to obtain swift and accurate feedback.

For the Android Development aspect, the system embraces both Flutter and Android Studio. Flutter facilitates the creation of a seamless and visually appealing user interface, ensuring a positive user experience. Android Studio, on the other hand, provides a robust development environment, allowing for the integration of sophisticated features and functionalities.

Furthermore, Voice Assistance technology is integrated into the system, enhancing accessibility for visually impaired users. This feature ensures that users receive spoken feedback, enabling them to distinguish between different currency notes independently and efficiently.

Collectively, this multi-faceted approach, encompassing Machine Learning, Image Processing, Android Development, and Voice Assistance, positions the proposed system at the forefront of currency detection technology for blind individuals. Through the synergistic integration of these technologies, the system aims to set new standards in efficiency, accuracy, and user-friendliness, contributing to goal of fostering financial independent for individuals with visual impairments.

Machine Learning Algorithms: Image Pre-processing, OpenCV, and Classification

In the domain of machine learning, our project extensively employs various algorithms to address currency recognition challenges for visually impaired individuals. Firstly, image pre-processing techniques are applied to enhance the quality and clarity of currency images, ensuring optimal input for subsequent stages. OpenCV (Open Source Computer Vision Library) is a cornerstone technology utilized for image manipulation, feature extraction, and overall image processing. To tackle currency recognition, we employ robust algorithms including Brute Force Classification, which leverages straightforward matching techniques, and Principal Component Analysis (PCA) for dimensionality reduction and feature extraction. Additionally, the system integrates the ORB algorithm for keypoint detection and description, enhancing recognition accuracy, and the Local Binary Pattern (LBP) algorithm, which excels in texture analysis, contributing to the comprehensive currency recognition model.

Android Development with Flutter and Android Studio

The Android development aspect of our project is built upon the dynamic combination of Flutter and Android Studio. Flutter, a UI toolkit, facilitates the creation of natively compiled applications for mobile, web, and desktop from a single codebase. Its expressive and flexible framework enables the development of visually appealing user interfaces, crucial for an inclusive app catering to visually impaired users. Simultaneously, Android Studio serves as the integrated

development environment (IDE) for crafting the Android application. Its robust features, extensive libraries, and seamless integration with Flutter empower developers to create a user-friendly, accessible, and feature-rich Android app for currency recognition.

Voice Assistance Integration

Voice assistance plays a pivotal role in ensuring a user-friendly and accessible experience for visually impaired individuals.Leveraging natural language processing (NLP) techniques, the system interprets user commands and provides real-time, spoken information about the recognized currency denominations. This aspect of the project is instrumental in fostering inclusivity, as it enables visually impaired users to confidently navigate financial transactions independently, contributing to the overarching goal of creating an empowering and for individuals with visual impairment.

VII. METHODOLOGY

The proposed Android application for Indian currency detection integrates user authentication, emergency messaging, and currency recognition using a convolutional neural network (CNN). The system begins with a login and registration module, ensuring secure access for users. Upon successful login, users can interact with the application through specific hardware buttons for streamlined functionality: pressing the volume up button sends an emergency message, while pressing the volume down button initiates the currency detection feature.

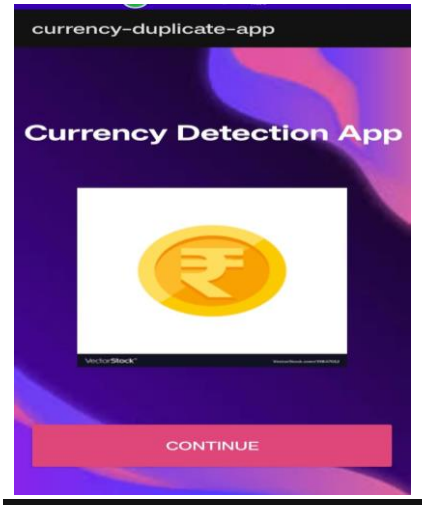
The core functionality of the application revolves around its currency detection capability. When a user opts to detect currency, the system requests camera permissions to proceed. This step ensures user privacy and security by allowing users to control access to their device's camera. Once the permission is granted, the application activates the camera, enabling the user to capture an image of the currency note. This image serves as the input for the detection algorithm.

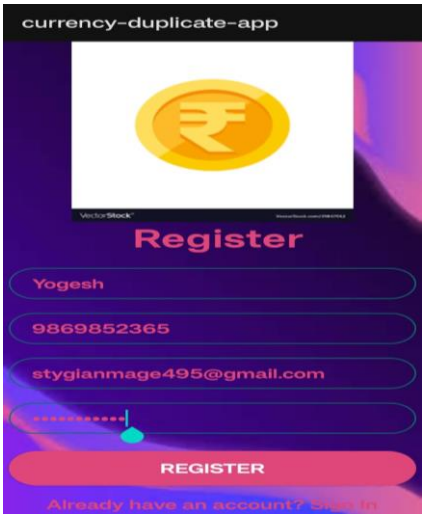
For currency recognition, the system leverages a pre-trained convolutional neural network (CNN) model. CNNs are highly effective for image recognition tasks due to their ability to automatically and adaptively learn spatial hierarchies of features. The captured image of the currency note is processed by the CNN model, which analyzes the visual features and patterns to identify the denomination. The model has been trained on a diverse dataset of Indian currency notes, ensuring high accuracy and reliability in real-world scenarios

Upon successful identification, the application provides the result to the user in an accessible voice format. This feature enhances the usability of the application, particularly for visually impaired users or situations where visual confirmation is impractical. The text-to-speech conversion ensures that the denomination of the currency note is communicated clearly and promptly.

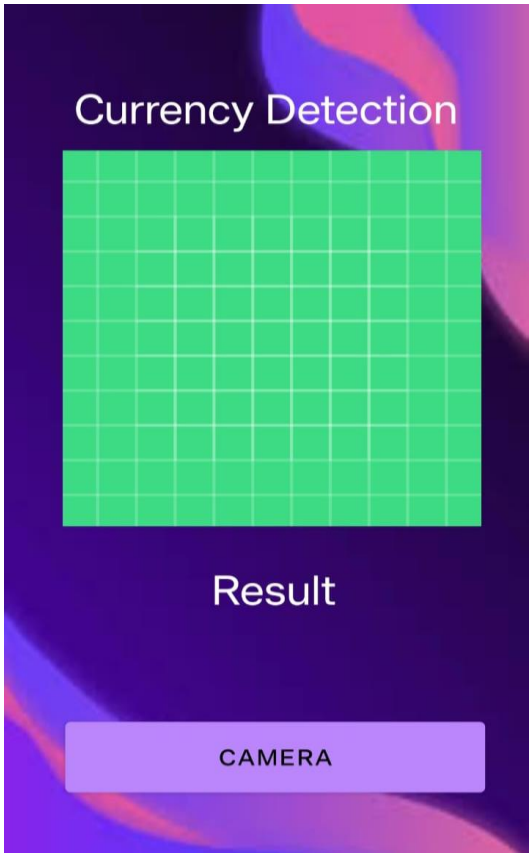
In addition to currency detection, the application includes an emergency messaging feature for added user safety. By pressing the volume up button, the user can instantly send a pre-configured emergency message to a designated contact. This functionality is designed to be quick and easy to use, providing an essential safety net for users in distress. The integration of these features—secure login, currency detection, and emergency messaging—creates a comprehensive and user-friendly Android application for Indian currency recognition.

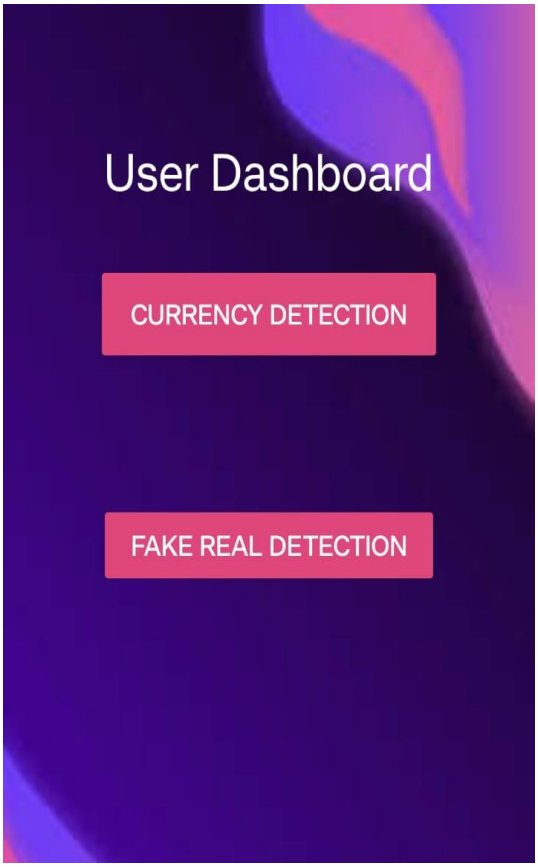
VIII. RESULT

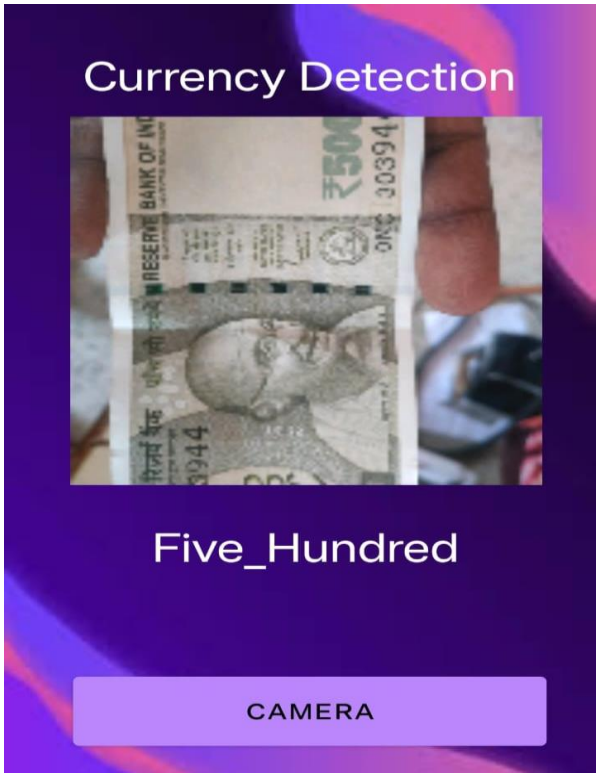





currency-duplicate-app
Press volume Down Key For Detection And Press volume Up Key For Send Emergency SMS
successfully Login


Currency Detection
Result
CAMERA


User Dashboard
CURRENCY DETECTION
FAKE REAL DETECTION


Currency Detection
Five_Hundred
CAMERA

Output Page:

CONCLUSION

In conclusion, the currency detection system for blind individuals, propelled by cutting-edge technologies such as machine learning and computer vision, represents a transformative leap in assistive technology. The seamless integration of a camera module and a sophisticated deep learning model, complemented by a user-friendly interface, guarantees an accessible and empowering experience for visually impaired users. This project serves as an inspiring example of how technology can be harnessed to improve the lives of individuals with visual impairments, providing not only practical currency management tools but also fostering inclusivity.

The envisioned outcome of this innovative system extends beyond mere currency identification; its ultimate goal is to empower users to confidently navigate financial transactions independently. Through the embrace of advanced image recognition and natural language processing, the system contributes significantly to the broader societal objective of creating an inclusive and supportive environment for individuals with visual impairments. The combination of accurate currency management tools and the promotion of independence resonates with the core principles of accessibility and empowerment, aligning seamlessly with the overarching mission of enhancing the quality of life for individuals facing visual challenges.

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